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РОССИЙСКАЯ ПРОГРАММА ЭКОНОМИЧЕСКИХ ИССЛЕДОВАНИЙ

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Content

Introduction

In August of 1998 Russian banking system faced the most devastating crisis in its history. Although before the time there were another banking crises in Russia it was the first one that resulted in such a huge number of banks' failures. More than 60% of large and multidivisional banks closed their doors (table below).

Solvency and Financial conditions of Russian banks January 1999

Types of banks	required f. support		didn't require f. Support	
	Quantity	Total assets	Quantity	Total assets
Multifunctional banks with large number of branches	4	145,7	0	0
Large	14	328	5	139,7
System banks	26	29,8	53	25,2
Other	397	208,8	974	157
Total	441	712,4	441	712,4

Source: survey of IC "Troika Dialog" "The Russian Banking sector: Life after Death"

Through the destruction of the saving and payment systems the crisis extremely severely affected the state of the economy as a whole. Thus the refusal to pay back deposits caused the loss of the population trust in banks as a way of saving. Nonfulfilment of obligations to foreign creditors sharply cut down the access of Russian companies to foreign credit sources. The bankruptcy of almost all multidivisional banks caused a significant decrease in the quality of banking service etc. Though the factors and a number of others caused by the banking crisis worsened not only current state of Russian economic agents but considerably complicated their ability for future development.

Such a severe influence of the crisis and its unexpected occurrence stimulated researchers to study the reasons of the fall. They distinguished a number of economic factors that acted as the main source of the crisis (***see Appendix***). At the same time institutional aspects were not considered. Meanwhile, a proper banking regulation together with the toughening of control over compliance with the requirements could not only reduce losses of

the economy in 1998, but even could lessen the probability of the crisis occurrence.

This work is meant to fill in the gap. It presents an attempt to describe and analyse most significant shortcomings of Russian regulation system and present possible ways for its improvement. The main attention is paid to possible effects of the capital and reserve requirements toughening. The examination is based on the experience of developed countries and in most complicated cases (toughening of capital and reserve requirements) a theoretical model is also applied.

The most interesting result of the paper is the description of possible effect of the capital and reserve requirements. It was shown that in Russian reality, when a lot of banks had long-term investment portfolios and insufficient funds for their financing, these two regulations could have positive effect. In particular, it was demonstrated that in case, well-timed toughening of capital and reserve requirement applied to large Russian banks could considerably improve their stability. However, in case of banks with comparably small long-term portfolios the same regulation could have opposite effect. Furthermore, it was shown that introduction of bank specialisation could make possible improvement of soundness of both groups of banks.

Literature review

The problem of the optimal implementation of banking regulations is very important but is extremely complicated too. These two characteristics of banking regulations forced researchers to spend time on investigations in this area. Nowadays a huge number of different papers consider various aspects of regulations.

General regulation theory is concerned with the design of the optimal regulatory rules. It is therefore mainly normative. However, only a minor part of the literature on banking regulation follows this “regulation design” approach. The main part of papers uses a “positive” approach- “regulation analysis. Because the influence of regulation is very difficult to distinguish, most of these papers use mathematics models.

These papers can be divided into three groups: free banking, various bank regulations and the optimal choice of banking regulations.

The first group presents articles, which argue that there is no need to control any activities of bank to obtain a stable general equilibrium. The most famous paper in this group is **Fama (1980).** According to **Fama (1980)** there is no reason to regulate banks or banking competition with respect to payment services and portfolio management: a competitive outcome would be optimal. In making the case for free banking, this paper and other such as **Wallace (1983), Rolnick** and **Weber (1983)** and **White (1984)** have presented some challenging ideas. Nonetheless, the cases made for free banking in the literature remain unconvincing. First, it is not clear that the incomplete historical analysis concerning the 19th century holds relevance for the modern integrated economy. Second, either implicitly or explicitly, most analyses of the banking sector have assumed the existence of economies with centralised markets and with complete information available to all parties. Moreover, models with centralised trade and complete information are incapable of answering arguments traditionally made against free banking.

The second group of paper proves that 'Free banking always results in a bank crisis'. In particular, they show that a possible banking sector failure is associated with classes of information-related functions of banks. For example, the fixed claim demand deposit contract allowing an early withdrawal of funds ensures optimal risk sharing, but simultaneously makes a panic bank run possible (**Diamond, Dygvig 1983, Jacklin 1983 and Haubrich 1985**) or a fundamental or information-based bank run when depositors have information about the return of the bank and the value of its assets may also trigger bank insolvency (**Jacklin, Bhattaharia 1988**). Papers from the group also stresses attention on the risk-taking bias implied by the inability of depositors (possibly encouraged by deposit insurance to invest in deposits) to observe the asset portfolio risk chosen by the bank (**Merton 1977, 1978, Bhattaharia 1982**). It is shown that in such a world, capital requirements may reduce risk taking. A number of papers analyse the link between competition and prudential concerns. They have stressed the fact that the expectation of future rents makes it more costly for a bank to fail and introduces a mitigating factor against excessive risk taking**. Bhattacharya**

(1982) has argued that deposit rate ceilings could act as a deterrent, but could be Pareto worsening too if inducing a large increase in risk taking. **Chan, Greenbaum,** and **Thakor (1992)** have argued that the existence of sufficient rents may be a precondition for a useful role for risk-sensitive deposit insurance premiums.

The last group of papers is concerned with the problem of optimal use of regulations and does not discuss the question "Whether any regulation is desirable or not?". They take the statement that 'Regulation is useful' as given, and focus their attention on the problem of optimal use of regulations.

The mostly well developed method in modern literature is deposit insurance. The aim of this regulation is to avoid bank panics and their social costs. A number of papers shows how deposit insurance could provide a solution to bank runs **(Wallace 1988)**. Problems associated with the implementation of the insurance and its effects on the banking industry are considered in another group of papers. **Merton (1977)** proposes method for finding the appropriate pricing policy for deposit insurance using the arbitrage pricing. **Gennote** and **Pyle(1991)** shows that deposit guarantees would lead to inefficient investment and that the increase in bank capital requirements could not compensate for the increase in risk.

The influence of capital requirements on banks' investment decisions is considered in the next papers (**Blum 1999**, **Park 1997**, **Kane 1995**, **Berger 1995**). **Berger** examines the role of capital in financial institutions- why it is important, how market-generated capital requirements differ from regulatory requirements, and the form that regulatory requirements should take. Along the way, he examines historical trends in bank capital, problems in measuring capital, and some possible unintended consequences of capital requirements. Within the framework, he evaluates how the contributions to this special issue advance the literature and suggest topics for future research. **J. Blum** uses a dynamic framework. The paper shows that capital adequacy rules may increase a bank's riskiness. In addition to the standard negative effect of rent on risk attitudes of banks further intertemporal effect has to be considered. The intuition behind the result is that under binding capital requirements an additional unit of equity tomorrow is more valuable to a bank. If raising equity is excessively costly, the only possibility to increase equity tomorrow is to

increase risk today. **S. Park** analyses the value maximisation of regulated banks within a moral-hazard framework. The paper presents an interesting result. Larger charter value results in a higher-risk interior solution.

Thomas F. Hellmann et al. (1998) considers another type of regulation. They consider the implementation of deposit rate restrictions and capital requirements. **Hellman** shows that competition could undermine prudent bank behaviour. Capital requirements reduce gambling incentives by putting equity at risk. Any Pareto-efficient outcome can be achieved by adding deposit rate controls as a regulatory instrument. Even if deposit rate ceilings are not binding on the equilibrium path, they may be useful in deterring gambling off the equilibrium path.

Another method, the portfolio regulation examined by **Crouhy** and **Galai (1986)**, **Kim** and **Santomero (1988)**. The main idea is that if banks behave as portfolio managers when they choose the composition of their portfolio of assets and liabilities, then it is important to use risk-related weights for the computation of the capital to asset ratio. For example, **Kim (1988)** paper investigates the role of bank capital regulation in risk control. Utilising the mean-variance model, the paper shows that the use of simple capital ratios in regulation is an ineffective mean to bind the insolvency risk of banks, moreover it derives risk weights under the risk based capital plan. Another example is **J. Blum (1999)** paper. It demonstrates that although, in principle, portfolio regulation may reduce the probability of bank failure, its current implementation may produce perverse results. That is, bank portfolio regulation, by restricting high-risk, high-return assets, may actually increase the probability of bank failure. And it proposes a more efficient method of portfolio regulation, which eliminates the probability of the regulation leading to greater rather than smaller total exposure. This paper belongs to this group. Although it considers all shortcomings of Russian banking legislation, the main attention is paid to the problem of optimal use of portfolio regulation. It analysis the impact of capital and reserve requirements regulations on bank risk by assuming that banks can invest in projects that have a positive NPV denoted there as long term investments. One of main results is that although capital and reserve requirements could have positive as well as negative

effect on bank stability, in Russian case it was reasonable to tougher this regulation.

Literature used for the description of the causes of the banking crisis

The analysis is based on the empirical papers presented by the leading Russian economists during the last year.

"Banking system of Russia: crisis and future prospects." published by an analytical laboratory "Vedi" in 1999 contains a complete analysis of changes, that Russian banking system undergo as a result of August crisis in 1998. The authors investigate in details the major prerequisites of the banking crisis. A special attention is paid to the interdependence between banks and the state bond market. In addition, there is a thorough description of banks' relations with Russian and foreign economic agents.

Another paper containing a valuable analysis of banks' bankruptcy causes is the report "The Banking Crisis: Was fog dissipated?" published by the Development Center. Most of the Center's researchers had a reach working experience in the CB and the report gives to external analyst a chance to examine the crisis from the point of view of the people directly involved in the process of the decision making.

The third example of papers, that contain an attempt to describe causes of banks' destruction, is A. Astapovoch and D. Sirmolotov paper "Russian banks in 1998: the developments of the system crisis".

In addition data from different other papers were used too such as the surveys of the investment company "Troika-Dialog": "The Russian Banking Sector: Life after Death" and "The Russian banking Sector at Crossroad". The papers contain extensive analysis of the banks' foreign market activities. In addition, some data were taken from A. Chernyvskiy paper "The perspectives banking crisis overcoming in Russia".

The review of institutional and regulatory frameworks for the bank systems of developed countries and Russia.

Before the discussion of Russian banking regulation shortcoming and their comparison with Western countries experience, let us depict main

characteristics of Western and Russian banking legislation.

Italy

The Italian banking sector consists of commercial, savings, co-operative and rural banks, which according to the Banking Law of 1936 (frequently amended) form the group of credit institutions authorised to receive deposits and grant credits for their own account. Credit institutions and Postal Administration are the main providers of payment services. The Bank of Italy supervises stability and competition in the banking system, as well as activities of non-banks operating in the payment system.

The distinct feature is the still remaining significant specialisation within the banking system as banks' equity participation in non-financial firms is banned. Bank ownership is not explicitly provisioned, but the Bank of Italy, which is in charge of the anti-trust policy, has overseen that non-financial companies do not exercise dominant influence over banks. In regard to other structural regulations, the establishment of open-ended mutual funds was allowed and their functioning regulated in 1983, and in 1988 the direct linking of money market mutual funds to banks checking accounts was permitted. Open-ended mutual funds have developed briskly and compete directly with banks over household savings. Investment banking activities were allowed for commercial banks in 1977.

The deregulation of conduct speeded up in the late 1980s.
Short-term lending was allotted to commercial banks and the medium- and long-term lending to special institutions. In 1983 an agreement on lending and borrowing rates and a quantitative ceiling on bank loans, and in 1987 the requirements of non-interest bearing deposits against foreign assets were abolished. Restrictions on the establishment of bank branches were partially relaxed in 1987, while the final liberalisation took place in 1990. High reserve requirements have been used in Italy to ensure financial stability and exercise monetary control.

France

The banking law classifies the credit institutions into four categories. Commercial banks that perform all types of banking and associated

operations like foreign exchange transactions and marketing of transferable securities and financial products. Structured network of banks, which comprise mutual and co-operative banks. Finance companies engage mainly in lending or securities trading according to the limits of their statuses. They are not generally allowed to take deposits from the public for terms of less than two years. Specialised financial institutions carry out duties of public interest assigned by the state, and are not authorised to conduct operations not related to their assignments

In France a uniform legal framework for the conduct of banking operations is provided by the Banking Law of 1984.The Law imposes upper limits for credit institutions to engage in other than banking activities. The net income from these may not be greater than 10% of the global net income of a credit institution. France has undertaken a significant deregulation of conduct mainly during the 1980s. The bank lending rates were deregulated already in 1967, but the controls on credit volume persisted. They were removed partially in 1984 and totally cancelled in 1986.Since 1986, interest rates on time deposits with maturity over three months can freely follow market rates, and banks' service charges, various commissions and fee, are fully unrestricted. However, nominal rate on demand deposits is still laid down by rulings of the Committee on Banking regulations. Establishments of the branches was liberalised at the beginning of the 1980s, which led to an intense competition over market shares via opening of new branches. Since 1990 France follows the EC Directive on Solvency Ratios, which has meant adjustment to stronger requirements. As to structural regulations, the specialisation within the banking system was ended in 1984 as universal banking operation were fully allowed. Remaining capital controls were cancelled partly in 1986, and full liberalisation was achieved in 1990.

Germany

German banking system is the least regulated market in Europe without any significant structural and conduct regulations. German universal banks conduct a full range of both commercial and investment banking services, but do not constitute a homogeneous sector of banks. According to respective legal statuses, universal banks are divided into commercial, saving

banks and credit co-operatives, which each have separate banking associations and deposit protection schemes. Commercial banks are organised as limited liability companies and comprise also different subgroups. The first one comprises the largest commercial banks that operate nation-wide branch and own giro transfer networks. The second set consists of commercial banks concentrating strictly regionally or operating only a few branches nation-wide, and the last consist of single banks, branches and subsidiaries of foreign banks and private bankers.

The only tough restriction is the capital requirements that are high even in European standards. Other quantitative restrictions regarding equity, liquidity, investments, large-scale loans and loan concentration aiming at protecting the functioning of the banking system have been in general less restrictive then the stipulations of the EC Directives.

The United Kingdom

The UK banking market consists of authorised banks organised as public limited companies operating under the Bank Act of 1987, and of building societies ruled by the Building Societies Act of 1986. Authorised banks are divided into two distinct subgroups. Namely, clearing banks offering a wide range of banking services, and other authorised banks consisting of smaller deposit-taking banks, consortium banks, discount houses and foreign-owned banks.

The UK banking market has been historically slightly regulated, as the German system, compared to other European countries. In 1986 authorised banks, both domestic and foreign, were allowed to engage in securities business allowing them to conduct universal banking. Most stringent structural and conduct regulations have been pertained to building societies. By the 1986 Act building societies were allowed to engage in unsecured lending and to provide credit cards that led to an expansion of services provided especially by the largest societies. The interest rate recommendations for building societies were cancelled in 1984, and wholesale borrowing was gradually permitted for the societies between 1980 and 1988. In 1989 new solvency ratios in accordance with BIS requirements were implemented. There are no constraints on banks' ownership in non-financial firms in the UK.

Spain

According to the Spanish Banking Law of 1988 credit institutions engage in borrowing funds and granting loans on their own account. The banking system consists of commercial banks, saving banks and credit co-operatives. Each of three bank groups has heir own deposit guarantee fund, which are financed by banks in proportion to their liabilities and by contributions from the Bank of Spain, Banking supervision is carried out jointly by the Ministry of Finance and the Bank of Spain.

Currently prevailing regulations do not give a competitive edge to any of the three groups of institutions, since saving banks and credit co-operatives are authorised to perform identical functions as the commercial banks. Company finance has been traditionally handled by commercial banks, but saving banks compete increasingly with commercial banks in this market. Individual saving banks are grouped into two separate entities, namely the Confederation of Saving Banks and the public Postal Savings Bank. Other financial institutions operating in Spain are Official Credit Institutions: the Institute of Official Credit and the Official Credit Banks.

The Spanish banking system has undergone a very rapid liberalisation process during 1980s' from a heavily regulated system to close free-market business where most conduct and structural rules have been removed. Entry of domestic institutions was significantly restricted until 1988 shielding the incumbent institutions from competition. Interest rate and commissions regulations were lifted gradually between 1977 and 1987, and credit ceilings by 1990. Establishment of branches was freed totally in 1985 for commercial banks, but some restrictions remained for savings banks until 1990. Spain has adhered to discretionary regulations against foreign banks in regard to establishment of branches and composition of their assets and liabilities. Only some of the restrictions were lifted between 1986 and 1992. Thus, a significant change took place on January 1 1993 when the establishment and operations of foreign-owned banks were liberalised abolishing the discretionary power of the Spanish authorities. Another significant change in regulations concerns the solvency requirements. Replacement of BIS standards by the EC standard denotes a strengthening of requirements to

some extent, since in Spain, as in Germany and Italy, the importance of undisclosed reserves through the undervaluation of securities has been higher than elsewhere.

The banking deregulation in the EC.

The banking deregulation in the EC area began in the late 1970 that along with the liberalisation of capital flows has significantly affected the evolution of the banking markets. The adopted EC legislation and the anticipation of future developments have significantly contributed to this process by triggering changes in national regulations.

Firstly, regulations on banks' competitive conduct have been relaxed and largely eliminated having significant behavioural effects on the respective banking industries by enhancing price competition. Secondly, deregulation of structural rules led to the adoption of the universal banking model as set up by the Second Banking Derivative in all countries.

Japan

Banking is one of the most heavily regulated industries in post-war Japan. Within industry, long-term banking and short-term banking have been separated; only trust banks have provided trust-banking services. Until the late 1970s most interest rates were set at non-market clearing levels. In addition, informational administrative guidelines have been widely used. The regulatory authorities protected banks essentially in three ways: First, many forms of subsidies were provided, including those arising from interest rate regulations, entry restrictions, and Bank of Japan (BOJ) lending at the discount rate. Second, significant portions of credit risks were borne by the government. Public financial institutions supplied funds jointly with private banks. The trust fund bureau bought large amounts of debentures issued by long-term credit banks. Most important of all, the Ministry of Finance (MOF) and the BOJ rescued troubled banks by any possible means. Third, the flow of funds through the capital market, especially the bond market, was severely controlled. Moreover, the decline in management efficiency expected from such heavy protection was minimised by the MOF's guidelines to limit bank expenses

Financial liberalisation of Japanese banking sector has been started in late 1980s. Many have attributed to the significant liberalisation that has taken place to the sharp increase in government budget deficits in the late 1970s and the resulting need to sell large amounts of government bonds. As discussed earlier, bank protection took three forms: discouragement of competition, sharing of credit risks by the government, and the restriction of direct finance. Part, but not all, of the first and third types of regulations were gradually relaxed. Most significant among these was the gradual deregulation of interest rates. But still the banking system of Japan is highly regulated.

USA

The building of regulatory system was started from passing the Federal Reserve Act of 1913. This act created Federal Reserve System. As it was in Japan the banking collapse of the Great Depression was viewed, rightly or wrongly, as being the result of excessive risk taking by banks. The legislation of the 1930s attempted to reduce such risk taking in number of ways. It limited competition by restrictions on geographic competition and by capping the rates banks could pay on deposits. It also segmented the financial structure to limit competition and to keep banks out of areas thought to be too risky. Under the new rules, commercial banks were to accept checking deposits and make commercial loan; investment bank were to underwrite and broker securities; thrifts were to accept time deposits and write mortgages; insurance companies were to accept insurance. No one type of financial institution was to invade the turf of any other.

The principal vehicle of this segmentation was the Glass-Steagall Act of 1933, which separated commercial and investment banking. The Bank Holding Company Act of 1956, which restricted the affiliation of banking and non-financial corporations, set banking further apart. The S&L Holding Company Act of 1969 did the same for S&Ls.

In addition to these measures to limit completion and risk taking, the government sought to promote stability directly by providing a guarantee in the form of deposit insurance. Congress added an additional layer of protection in the form of federal deposit insurance. The federal Deposit Insurance Corporation (FDIC) was to insure deposits up to a limit of 2,500 $

per depositor. All banks, not only members of the Federal Reserve System were eligible for this insurance. A parallel system was set up for saving and loans under the Federal Savings and Loan Insurance Corporation (FSLIC). However, deposit insurance was not entirely a new idea. Eight Western and Southern states had set up state-sponsored deposit insurance scheme after 1907. This system sunk after 1920's agricultural depression. Nowadays, the FDIC insured deposits at more than 10000 banks with more than 2.5$ trillion in deposits among them. Before 1989 FDIC insured only banks(commercial, saving bank and insured branches of the foreign banks); S&Ls were insured by FSLIC. However the S&L crisis bankrupted FSLIC, and it was taken over by FDIC. Each depositors is insured up to a maximum of 100,000$ in principal and accrued interests. Both banks and S&Ls pay an insurance premium of 0.23$ per 100$of deposits on all deposits, even those not fully insured. The cost of insurance has increased almost eight times from 1985 to 1993. But there are still some serious problems with solvency of FDIC. Because of bank failures in the late 1980s the reserves of FDIC ran out in 1991.It covered its losses by borrowing from the Treasury.

The desire to protect unsophisticated individuals motivated the Security Acts of 1933 and 1934. The acts require issuers of new securities to register with the SEC and to disclose all relevant information. Corporations whose securities are traded publicly are required to disclose information periodically. The Consumer Credit Protection Act of 1968, also known as the Truth-in-Lending Act, requires lenders to provide borrowers with accurate information about the cost of credit so they can more readily shop around. The Equal Opportunity Act of 1974 prohibits discrimination in credit evaluation. In addition, FED is charged with administering these laws.

(This description is based on literature listed in ***Appendix***)

Russia 1991-Aug 1998.

The first steps in the creation of prudential supervision legislation was undertaken by Central Bank shortly after its foundation. First document in this area was CBR Instruction №1 (Apr 30 1991) “About regulation of commercial banks activities”. It determined standards for capital adequacy, liquidity, risk per borrower and mandatory reserves of commercial banks. This document

with different variations existed until the end of 1995 and acted as one of the principal document of the Central Bank.

Only after interbank market crisis of August of 1995 the CB renewed its activities in the field of remote control. New edition replaced the previous variant of Instruction №1. In this new edition the list of standards was significantly enlarged.

- Minimum size of capital of new banks;
- Minimal amount of own assets for existing bank;
- Capital adequacy standards (h1);
- Liquidity standards(h2, 3, 4, 5);
- Maximum size if risk per borrower or group of linked borrowers (h6);
- Maximum size of credits or warrants, granted by banks to its stockholders and insiders (h8, 9, 10);
- Maximum amount of deposits of population (h11);
- Maximum amount of demand notes (h12, 12.1, 13);

Later it was extended with Instruction №59 (Mar 31 1997) “About application to credit institutions of discipline for violation of prudential norms”. According to this documents, prudential norms were defined as determined by Central Bank:

- Amounts of risks taken by credit institutions;
- Reserves created to assure liquidity and possible losses coverage;
- Requirements, violation of which can negatively affect financial conditions of credit institutions or possibility of accurate estimation if financial activities, including requirements for financial accounting and reporting.

These two documents were extended with the instruction that defined the notion of ‘problem’ bank. Letter of Bank of Russia №457 28.05.97 “On criteria of financial conditions of banks” was issued to refine the methodology of banks supervision and better condition for application of adequate measures. In particular, it defined the distinction between stable and problem banks. Although the notion of ‘problem group’ existed before that (CBR Letter №457 28.05.97) «On criteria of determining financial standings of banks»), new classification of banks was less formal and therefore more applicable. Especially unimportant was highlighting of quality of banks accounting, as in

general, violation in this field correspond with low qualification of accounting personnel or of intentional violations of banking law. Both of these factors will certainly lead the bank into severe problems.

Together with the developing of different regulation instruments CB issued a number of documents, which established the applications of different measures to banks-violators. According to CB Instruction №59 (31.05.97) the choice of measures was made according to character of violations, reasons for revelation, and financial conditions of credit institutions. Financial conditions was determined on the base of bank's accounting reports, results of inspections and auditors' conclusions according to CB Letter №265.

At the fall of 1997 Central Bank, worried about possible negative effect of Asian crisis on Russian banking system, renewed its activities in prudential supervision and took a number of measures to improve the existing legislation. The most significant one was the new edition of Instruction №1. The document was introduced on October 1 1997 and had been amended until the beginning of 1997. This document determined more accurately the procedure of calculation of existing standards and introduced several new norms (liquidity was on precious metals operations (n14)).

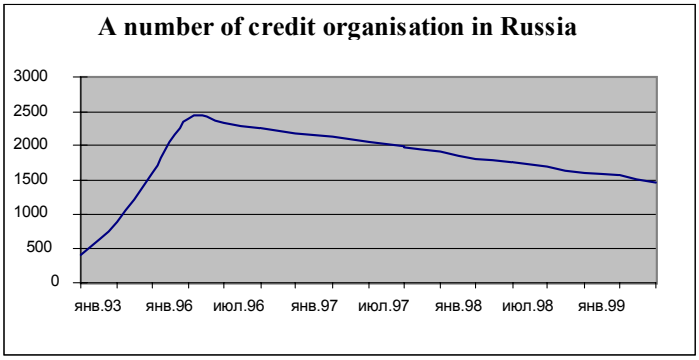
This document together with Instruction №1 of 23.03.97 was of additional importance for banks as it increased the minimal required level of capital. From Jan 1 1999 new value of minimal capital (determined as sum of registered capital, bank funds and non-distributed profit) was set at 5mln ECU. Banks, whose own capital lay between 1mln ECU and 5mln ECU was prohibited to make some operations and restriction of branch network development was introduced (later on, after the beginning of banking crisis, this requirement was eased). This way a lot of banks were made to change their status in a year as a majority of medium- and small-sized banks had to join larger structures or merge with them. Understanding that even in Moscow more than 25% of banks failed to satisfy the requirement, the CB issued a number of documents to ease the process of consolidation. First of these was Regulation №12-П of 30.12.97. This document accurately regulated the procedure of merger. As bank was not considered as newly created, it was not affected by registered capital standard. After merger new institution was got a license which contained full list of banking operations permitted for any

of merged banks. If one of the banks had general license, new structure inherited it. In case of joining the larger (i.e. the one that was joining) bank retain its license or got the new one – if joined bank had a general license or the one that permitted larger list of operations than larger bank. The Regulation also determined the procedure of registration of securities during the merger or joining and the order of conversion of their shares. Moreover, a number of documents, which regulated a limit of non-monetary part of registered capital, minimum amount of reserves for high-risk assets and coefficients for currency, interest rate and other risks were issued

Description and analysis of deficiencies of banking regulation

It is very difficult to underestimate the value of the Central Bank work in the years preceding the crisis. During the time it managed to make Russian banking legislation compatible with standards of foreign countries, a lot of actions were undertaken to ensure implementation of the decisions etc. At the same time reviewing CB job as regulating institute with regard to banking stability we have to admit that the constructed regulatory system was inadequate. And the August crisis is the most illustrative and direct evidence of the fact. It demonstrated that there were a lot of problems in Russian banking system concerned with its insufficient regulation. The deficiencies lay in ignoring the methods that proved their efficiency in countries with unstable economies, and secondly in inefficient use of existent regulations.

For instance one of the most substantial problems of Russian banking system was an excessive number of credit organizations. The number of banks increased five times during only two years. Moreover even in 1996-1997 when it began to decrease the growth of competition held because the large banks proceeded to expand their business in regions. For example SBS-Agro had more than 200 branches at the end of 1997.



In particular it leaded to the increase in degree of competition between financial institutions reducing profitability and thus value of existing domestic banks. It forced banks to engage in gambling activities, which in turn worsened their financial state. Moreover the superfluity of banking organisations resulted in the fact that majority of them had very small own capital and client base. Additionally it significantly complicated activities of supervising authorities.

Taking in account the problems described above it looks so strange that the CB did nothing to prevent the increase in the number of credit organisations. While the experience of developed countries demonstrates that there were a number of regulations suitable for the decrease in number of banks and bank competition as well as for the avoidance of its consequences.

One of the most famous and widely used methods of such a type is the direct restriction on the creation of new credit organisation and the expansion of existing one. While this solution was very popular in developed countries such as Japan, Canada and EU countries during unstable periods Russian regulatory authorities never used it. Thus in Italy restrictions on the establishment of bank branches were partially relaxed only in 1987.In similar manner in Spain the entry of domestic institutions was significantly restricted until 1988. In USA the restrictions are still in force (McFadden-Pepper Act (1927) and a number acts issued by states governments).

In addition to the direct restrictions the CB had another ways for the avoidance of excessive competition and its consequences. In particular it could apply deposit rate ceilings or increase the minimal required level of own capital.

The purpose of the deposit rate controls is to prevent interest rate competition that is destructive to the profitability of financial institution. The restriction was very popular in developed countries such as USA, Japan and Europe. Thus the Japanese deposit rates were confined by the “Temporary

Interest rate Adjustment Law" of 1947. In USA it was presented by the regulation Q that were abolished only in early 1980's (regulation Q prohibited payments of interest on business checking accounts, and allow the federal Reserve to pay interest on commercial bank balances required to be held at the Federal Reserve). In France the bank lending rates were deregulated in 1986, however nominal rates on demand deposits are still laid down by rulings of the Committee of Banking regulations. In Italy the regulation was abolished only in 1987. In Finland the regulation on banks' average lending rate were lifted step-by-step between 1983 and 1986, however the interest rates charged on a stock of loans still tied to the Bank of Finland base rate. Without regard to on the popularity of the methods it was factually not used in Russia. There was only one indirect restriction on interest rates charged by tax collecting authorities.

The second method the minimal capital requirement was used by the CB, but even it was used inefficiently. For the first until 1997 the minimal required level was defined in Russian currency which was subject to high inflation. Moreover the minimal required level was too low. Thus only at the beginning of 1996 it was defined in foreign currency and increased to 1 million ECU. The level was too low in comparison with major banking systems. Thus in EU countries The Second Banking Directive stipulates a minimum capital requirement of five million ECU to commerce banking operations.

The second problem that the CB failed to take into account was bank specialisation. Russia seems to be the only country that did not introduced bank specialisation at early stages of banking system development. Although this method was widely used in developed countries. In USA commercial and investment banking were separated in 1933 by Glass-Steagall Act. In Italy investment banking activities were allowed for commercial banks only in 1977. And although in other European countries the direct division did not implemented but supervisory authorities assumed that banking system consist of different groups and constructed the legislation on the base of it. Thus Spain credit institutions divided into private banks, saving banks and credit co-operatives and each of the three bank groups has own deposit guarantee funds.

The third problem was the fact that the legislation concerning banking sector relationships with other sectors was very weak. In particular the problem of banking holdings was not considered. There was no definition of banking holdings, who and how supervise them etc. The only document in this area was CB Regulation 12.05.98 «On consolidated accounting of credit institutions», but it was not enough for adequate supervision.

The next feature of Russian banking sector that negatively affected its stability was the lack of legislation concerning bank bankruptcy. In fact, facing the banking crisis the CB could not execute its own decisions. The illustrative examples of that were the cases referred to banks SBS-Agro and Menatep. It looks absolutely strange because Bank of Russia had similar problems during the previous banking crisis. Furthermore, not much attention was paid to the issue of creditors' rights. There was no notions concerning the responsibility of large stockholders and banks managers. In particular it resulted in the fact that a majority of large bankrupt banks managed to create "mirror" banks, to which their businesses were transferred. The most famous cases are presented in the table below.

Bank	Mirror bank
MFK ОНЭКСИМ	ROSBANK, Baltoneximbank
Russian Credit	IMPEXBANK
MENATEP	MENATEP St-Piterburg
Imperial	Petrocommertsbank
SBS-Agro	Perviy Ob'edinenniy Valutniy Bank

In addition to it, Russian banking system featured an excess riskiness of banks' behaviour. At the same time there existed a number of ways to reduce it. According to western countries experience it was possible to use reserve requirements, restriction on off-balance operations and open foreign currency positions etc. These methods were also used in Russia. Nevertheless a number of shortcomings concerning their application is worth mentioning. For instance, before the crisis of 1998 CB viewed GKOs as riskless assets and required zero backing. It indirectly forced banks to include GKO-OFZ in their portfolios while the riskiness of government securities at the beginning of 1998 significantly increased and corresponded to 4^{th} (or even 5^{th})

group risk. In the field of off-balance operations CB was also passive. Moreover, banks were stimulated to sign forward currency contracts which allowed the government to increase GKO attractiveness. As a result a large portfolio of forward contracts negatively affected the stability of banking institutions at time of the crisis. The situation with capital adequacy and reserve requirements a little bit more complicated. It is impossible to say whether its level was optimal basing only on the experience of other countries, so let us analyse it with the help of the model analysis.

Theoretical part

Influence of the capital and reserve requirement toughening

1. The description of the model from the economic point of view

Before we turn to the description of economic and mathematical formulation of the model, let us examine principal assumptions.

Firstly, the presented approach does not consider competition, while in reality its level was rather high. It is due to the fact that regulation methods analyzed in the framework are not concerned with the decrease in the level of competition. Additionally, the funds allocation market implied no direct competition as all large lenders belonged to either bank or FIG. On the market of short-term investments at times of GKO existence the level of competition was low as government covered the demand. The only field where large banks faced significant opposition of smaller institutions was the market of low-profit low-risk or riskless operations. But this fact was neglected in order to simplify mathematics of the model.
The previous motive also caused the use of simplified time structure of the model. Maturity aspects are taken into account in only way: bank profits from short-term operations should cover only the cost of debt paid at time t=1.

Sources of funds in our model are treated very simply – the bank can borrow at a fixed rate a sum proportional to its owned capital. This simplification is

fully deliberate as different banks had different sources of funds and it is very hard to model their behavior in a unified way.
Although the presented time structure is simple, nevertheless we assume that even in such setup we could demonstrate how the regulation affects the bank choice between short- and long-term investments and the level of risk.

2. Economic setup of the model.

At the beginning it is important to mention that the model is based on **J. Blum**'s paper. We use the same time structure and similar approach to short-term investments. But the approach to the problem presented in the model defers from **Blum**'s one in two ways. For the first our model analyses the impact of regulations on bank risk by assuming that banks can invest in long-term projects that have a positive NPV denoted there as long term investments *A(F)*, while **J. Blum**'s approach does not imply such a investment opportunity. For the second we assume that the cost of deposits is constant and does not depend on the bank behavior.

The main actor in the model is an economic agent, which at an initial moment of time owns a bank with some capital. With the help of the bank he collects deposits and invest them both in short- and long-term instruments. Bank can borrow an amount of funds, which is proportional to its owned capital. Certainly, this is not very realistic, still it is quite satisfactory as first approximation. Short-term instruments are viewed as financial tools that pay revenues each period of time, while long-term as investments into long term projects that provides profit to the holder only at the end of the maturity. The banker maximizes its (expected) capital at time of realization of return from long-term investments. For the sake of model simplicity the banker is assumed to be risk-neutral.

As it was mentioned above, the bank can invest in short-term (in our model – one-period) and long-term (two-period) assets. Return on long-term instrument is taken to be scale-dependent, which implies existence of some "optimal" volume of investments. Short-term instruments are taken to be of two forms – riskless and risky. The return on riskless asset is assumed to be fixed (scale-independent). The return of risky instrument is also scale-

independent and controlled by the bank, but depends on probability of getting positive return on the instrument. Such a setup implies existence of optimal risk level. The model allows to examine both the choice between short- and long-term instrument and influence of regulation parameters on "optimality" criteria from the bank point of view.

3. The description of the mathematics part of the model

The model has the following simple time structure. At time t=0 the bank can invest all available funds. After one period at time t=1 returns on short-term investments are realized. If the bank does not default at time t=2 returns on long-term investments are realized too. Although in reality bank reinvest its money at time t=1, we will assume that the bank simply stores any free funds it has at t=1 (in order to simplify time structure of the model). The final returns are realized at time t=2 and all parties are compensated.

It is assumed that the bank manager is risk neutral and act perfectly in the interest of shareholders. This implies that he maximizes the expected value of equity.

The bank is financed by equity(capital) and deposits. The initial stock of equity C is exogeniously given. Since depositors are poorly informed about bank activities they rely in their solutions on the value of the bank capital. Therefore the supply of deposits $S(C)$ depends on the value, where $S'(C)>0$. After one period, the bank has to pay the costs $R_1 * S(C)$.

At t=0 the bank has three investment opportunities: a safe short-term asset, a risky short-term portfolio and a risk-free long-term instrument.

The safe short-term asset has (gross) rate of return R.

The risk-return structure of the short-term portfolio can be influenced by the bank. It can choose a risky short-term instrument from portfolio.

Specifically, it is assumed that any instrument from risky portfolio has the following two-point distribution of the gross rate of return R with the lower realization normalized to zero:

$$R_r = X \text{ with probability } 1-p(X)$$
$$R_r = 0 \text{ with probability } p(X), \qquad (3.1)$$

For $X \geq R$, with $p'(X)>0$, $p''(X)>0$ and $p(R)=0$.

To avoid corner solutions with infinite risk after some point a further increase in risk leads to a decrease in expected return. To satisfy this condition it is assumed that $E(X)=(1-p(X))X$ is strictly concave. In order for the expected return to be increasing in X at R, it is further assumed that $1-p'(R)R>0$. The unique level of risk that maximizes expected return is denoted by X^* (i.e. $1-p'(X^*)X^*=0$). Denote also maximum expected return by

$$R^* = X^*(1-p(X^*)) \tag{3.2}$$

Obviously, the safe asset is (weakly) dominated by the risky portfolio.

In addition to short-term investment the bank can make long-term one. The difference between long-term and short-term investments is that in case of long-term investments the bank does not receive any dividends in interim period and long-term instrument is risk-free – if the bank lives through interim period, it will certainly collect return in the final period. In our case the interim period consists of time $t=1$. The final return on the long-term investments $A(F)$ depends on the value of the investments F in the following way $A(F)\geq 0$, $A'(F)>0$, $A''(F)<0$.

If the profits from short-term investments at $t=1$ are not sufficient to cover the costs $R_1 S(C)$, then the bank defaults and all available funds (if any) are transferred to the depositors. Due to limited liability bank owners cannot be forced to pay any additional amount of money to cover unfulfilled claims.

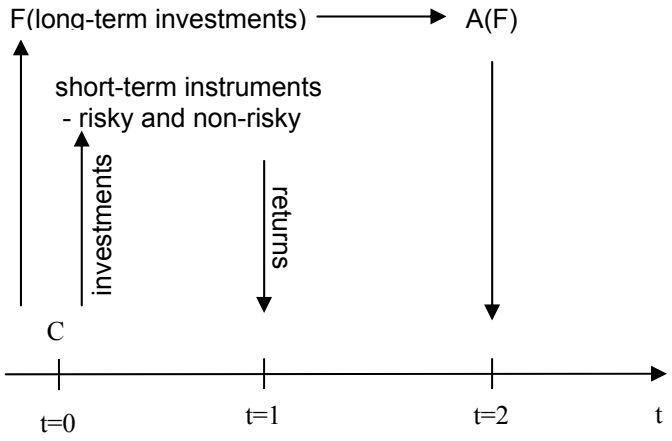
At time $t=1$ the model has a little different structure from the structure at $t=0$. The costs of deposits $S(C)$ at time $t=1$ is 0, bank do not reinvest the available funds (initial capital C at $t=0$ plus the profits or losses of the first period reduced by amount of long-term investments). It is worth to mention that the model could be easily generalized to allow for richer structures in *period 2*. While possibly more realistic, a true replication of the first-period structure in *period 2*, however, would render the model analytically intractable. The main consequence of the present approach is that the incentive for asset substitution in **period 2** is neglected. But since we are interested in the choice of the bank portfolio risk at $t=0$, doing so does not qualitatively affect the results of the paper.

In our model we will use $S(C)$ of a special form $S(C)=kC$, where k is a positive constant .

Further, we suppose that R_1 (the cost paid by the bank to lenders) is not

more than *R* (the rate of return on non-risky short-term asset and minimal return of risky one – if it succeeds). This is quite natural, as short-term instruments are usually profitable for banks. Under this assumption the bank will leave no funds non-invested at *t*=0. Thus if we denote the share of short-term risky investments by α, then the volume of funds invested into risky instruments is $\alpha((1+k)C-F)$ and into non-risky (short-term) instrument $(1-\alpha)((1+k)C-F)$.

Finally the time structure of the model can be described by following scheme:



As it can be easily seen, R_1 (lending rate) can be taken to be unity. Indeed, if it is not so, we can transform the model in the following way:

$$\begin{aligned} &R_1 \to 1, \\ &R \to R/R_1, \\ &A(F) \to A(F)/R_1, \\ &p(X) \to p(X/R_1). \end{aligned} \qquad (3.3)$$

After such transformation (which scales all monetary and rate variables concerning interim and final periods with the rate of R_1), the maximization problem of the bank remains essentially the same, which justifies assumption of R_1=1.

. In addition we will assume that short-term lending and deposit rate are equal *(R=R₁=1)*, although in some cases (for better understanding) we will continue to mark the return on safe assets and deposit rate as *R* and *R₁*

An optimal choice of the bank

In case of no regulation the bank manager maximizes the final profit at *t=2*. It can be described by the following optimization problem:

$$(1-\text{default probability})\times[\alpha((1+k)C-F)X+(1-\alpha)((1+k)C-F)-kC+A(F)]+ \\ +(\text{default probability})\times 0\to\max_{F,X,\alpha}, \tag{3.4}$$

where α is the share of risky short-term assets.

Due to limited liability the value of equities in case of default is zero and the bank can not continue operations. Hence the second term is zero.

Let us now calculate the default probability. There are three possible cases.

1) The first case is when the failure of the risky short-term investments, the bank stays sound. In term of our framework it means that return from riskless instrument cover current expenditures at time *t=1* or

$$(1-\alpha)((1+k)C-F)R\geq kCR_1. \tag{3.5}$$

In other words, if $(1-\alpha)((1+k)C-F)\geq kC$, then default probability is zero (safe policy);

2) The second case is when the bank stays sound only in case of risky short-term investment success, This assumption is equivalent to:

$$\alpha((1+k)C-F)X+(1-\alpha)((1+k)C-F)R\geq kCR_1 \tag{3.6}$$

and

$$.\ (1-\alpha)((1+k)C-F)R<kCR_1. \tag{3.7}$$

In this case, the default probability equals *p(X)*;

3) The third one is when even in case of successful short-term investment realization the bank will go bankrupt. More precisely:

$$\text{if } \alpha((1+k)C-F)X+(1-\alpha)((1+k)C-F)R<kCR_1 \tag{3.8}$$

and $(1-\alpha)((1+k)C-F)R<kCR_1$, then *default probability=1*.

4. Calculations

- *The case of safe investment portfolio*

It is a specific case, when the bank decides to behave absolutely safely. In the case investments into safe asset will be chosen in order to cover short-term expenditures.

$$(1-\alpha)((k+1)C-F)R \geq kCR_1 \tag{4.1}$$

as we assumed $R=R_1=1$ then

$$\alpha^* \leq \frac{(k+1)C-F-kC}{(k+1)C-F} \Rightarrow \alpha^* \leq \frac{C-F}{(k+1)C-F} \tag{4.2}$$

The rest will be distributed between risky asset (because it can be more profitable) and long-term investment.

As in this case *default probability=0* then bank's problem can be simplified to:

$$X(C(1+k)-F)(1-\alpha^*)+A(F)-kC \rightarrow \max_{F,X}. \tag{4.3}$$

Let us assume that *A`(C)>max [X*(1-P(X*))]*. This means that long-term investments are attractive enough for bank when its own capital is relatively small. In this case the "safe" choice of the bank assumes that bank will choose not to invest in the risky assets (α*=0*). Therefore the bank will invest *C* into long-term project and all the rest will be invested into safe short-term instrument. So we can write: *F=C, X=1*.

- *The case of risky investment portfolio*

Suppose now that bank opts not to behave safely, i.e. it chooses its portfolio so that it will be bankrupt if return on its risky short-term investments turns out to be zero (i.e. probability of bankruptcy is p(*X*)) (case 2).

Proposition 1 In this case the bank has no incentives to invest into safe instrument $\alpha = 1$

Proof.

□ Let us assume that α*<1*. The default probability does not depend on the value of α and equals *p*(*X*). In case of bankruptcy the bank losses do not

depend on the value α too, while in case of success the rate of return on short term portfolio is maximized when all available funds are invested into risky instrument, thus $\alpha=1$. ■

As $\alpha=1$ then the bank's problem looks as follows:

$$(1-p(X))(((k+1)C-F)X-kC+A(F)) \to \max_{X,F:s.to:} \quad X((k+1)C-F)-kC \geq 0 \quad (*) \tag{4.4}$$

- *The case of "interim" solution*

Suppose now that $X[(k+1)C-F]>Ck$, i.e. that at t=1 the bank in case of "good" realization the return on short-term assets gives to the bank more than enough money to cover short-term expenditures. Let us denote this case as "interim" solution. As we have strict inequality, the first-order conditions will look as follows:

$$\underset{F}{\text{FOC}}: \quad (1-p(X))(-X+A'(F))=0 \quad \Rightarrow \quad X=A'(F) \tag{4.5}$$

$$\underset{X}{\text{FOC}}: \quad (1-p(x))((k+1)C-F)-p'(X)[((k+1)C-F)X-kC+A(F)]=0. \tag{4.6}$$

This type of solutions can be characterized by the following proposition:

Proposition 1. In case of "interim" solution level of risk chosen by bank is less than X^*, i.e. $X \leq X^*$.

Proof.

□ Suppose that $X>X^*$. That means that:

$$[1-P(X)]\times\{X[(k+1)C-F]-kC+A(F)\}>$$
$$>[1-P(X-\Delta X)]\times\{(X-\Delta X)((k+1)C-F)-kC+A(F)\}=$$
$$=(1-P(X-\Delta X))\times\{(X^*-\Delta X)((k+1)C-F\}+(1-P(X-\Delta X))((k+1)C-kC+A(F))=$$
$$=(1-P(X-\Delta X))\times\{(X^*-\Delta X)((k+1)C-F\}+(1-P(X-\Delta X))(C+A(F)-F);$$

where $X^*=X-R_f=X-1\geq 0$

So at small enough ΔX:

$$[1-P(X)]X((k+1)C-F) < (1-P(X-\Delta X))(X-\Delta X)((k+1)C-F);$$
$$(1-P(X))(C+A(F)-F) < (1-P(X-\Delta X))(C+A(F)-F),$$

as *A*(*F*)>*F* and *C*+*A*(*F*)-*F*>*0.*

These means that at the same *F* and less *X* the bank's expected profit is higher, but if decrease in *X* is small enough than the inequality $X[(k+1)C-F] > Ck$ still holds. The idea of the result is the next, if *X*>*X**, then small decrease in *X* increases expected profit from short-term investments while the bank will still have enough to cover its short-term liabilities.■

- *The case of "corner" solution*

Suppose now that the bank again chooses risky policy (so it will invest nothing into safe instrument), i.e. its problem is:

$$(1-p(X))(((k+1)C-F)X-kC+A(F)) \to \max_{X,F:s.to:}$$
$$X((k+1)C-F)-kC \geq 0 \quad (*) \tag{4.4}$$

Now assume that (4.4*) holds with equality. We call this case "corner" solution because the level of risk is chosen just to cover the short-term liabilities. In this case the problem will be simplified to:

$$(1-p(X))A(F) \to \max_{F,X:s.to:}$$
$$X((k+1)C-F)-kC=0. \tag{4.7}$$

Getting rid of *X*, we have: $X = \frac{kC}{(k+1)C-F} = \frac{k}{k+1-\frac{F}{C}};$

$$(1-p(\frac{k}{k+1-\frac{F}{C}}))A(F) \to \max_{F}. \tag{4.8}$$

First-order condition for *F* is:

$$\underset{F}{\text{FOC:}}\quad D(F,k)\equiv\left(1-p(\frac{k}{k+1-\frac{F}{C}})\right)A'(F)-p'(\frac{k}{k+1-\frac{F}{C}})\times\frac{k}{(k+1-\frac{F}{C})^2}\times\frac{1}{C}\times A(F)=0.(4.9)$$

5.The dependence of bank optimal choice on banking regulations

- ***The regulation that is similar to (h1) norm***

According to h1 standard the value of deposits has to be at least as high as a given fraction of own capital. In this model the h1 ratio can be easily modeled by restrictions on k.

- *The case of "interim" solution*

In this case the solution is given by:

$$\underset{F}{\text{FOC}}:\quad (1-p(X))(-X+A'(F))=0\quad\Rightarrow\quad X=A'(F)\Rightarrow F=F(X)=(A')^{-1}(X);\ (4.5)$$

$$\underset{X}{\text{FOC}}:\quad (1-p(x))((k+1)C-F)-p'(X)\left[((k+1)C-F)X-kC+A(F)\right]=0.\qquad (4.6)$$

Substituting the first into the second we obtain:

$$B(X,k)\equiv(1-p(X))((k+1)C-F(X))-p'(X)\left[((k+1)C-F(X))X-kC+A(F(X))\right]=0.(5.1)$$

Suppose that there exists such X^{**} that satisfies $B(X^{**},k)=0$. Than, if X^{**} and $F^{**}=F(X^{**})$ give in fact solution to maximization problem of the bank than $\left.\frac{\partial B}{\partial X}\right|_{X=X^{**}}=\left.\frac{\partial^2\pi}{\partial^2 X}\right|_{X=X^{**}}<0$.

We have $B(X(k),k)=0\ \Rightarrow\frac{dX^{**}}{dk}\times\frac{\partial B}{\partial k}+\frac{\partial B}{\partial k}=0\Rightarrow\ \frac{dX^{**}}{dk}=-\left.\frac{\partial B/\partial k}{\partial B/\partial X}\right|_{X=X^{**}}$ (see implicit function theorem). The sign of denominator is known. Let's look at nominator:

$$\frac{\partial B}{\partial k} = (1-p(X))C - p'(X)(CX - C) = C\big(1-p(X)-p'(X)(X-1)\big) = \\ = C\times(1-p(X)-p'(X)X) + C\times p'(X). \tag{5.2}$$

But (as we have shown) $X < X^*$, so (as $E(X) = [(1-p(X))X]$ is concave) $E'(X) = [(1-p(X))X]' = 1-p(X)-p'(X)X > 0$. Recalling that $p'(X) > 0$, we obtain that $\frac{\partial B}{\partial k} > 0,$ thus:

$$\frac{dX^{**}}{dk} > 0.$$

Now recall that *X*=*A'*(*F*) and *A*(*F*) is concave. Therefore

$\frac{dF}{dk} = \frac{dF(X^{**}(k))}{dk} = \frac{d(A')^{-1}(X^{**}(k))}{dX}\times\frac{dX^{**}}{dk} = \frac{1}{A''(F^*)}\times\frac{dX^{**}}{dk} < 0$, i.e.:

$$\frac{dF^*}{dk} < 0. \tag{5.3}$$

So, we have found how *F* and *X* react on changes in *k*.

- *<u>The case of corner solution</u>*

Recall first-order condition:

$$\underset{F}{\text{FOC:}}\quad D(F,k) \equiv \left(1-p\left(\frac{k}{k+1-\frac{F}{C}}\right)\right)A'(F) - p'\left(\frac{k}{k+1-\frac{F}{C}}\right)\times\frac{k}{(k+1-\frac{F}{C})^2}\times\frac{1}{C}\times A(F) = 0, \tag{4.9}$$

and $X = \frac{k}{k+1-\frac{F}{C}}$. Suppose *F** gives solution to FOC and to maximization problem of the bank. We are interested in sign of $\frac{dF^*}{dk} = -\left.\frac{\partial D/\partial k}{\partial D/\partial F}\right|_{F=F^*}$. Again, second-order condition gives: $\left.\frac{\partial D}{\partial F}\right|_{F=F^*} < 0.$ So we have to look at sign of nominator:

$$\frac{\partial D}{\partial k} = A'(F) \times \left(- p'\left(\frac{k}{k+1-\frac{F}{C}} \right) \right) \times \frac{\partial \left(\frac{k}{k+1-\frac{F}{C}} \right)}{\partial k} - \frac{1}{C} \times A(F) \times$$

$$\times \left[p''\left(\frac{k}{k+1-\frac{F}{C}} \right) \times \frac{\partial \left(\frac{k}{k+1-\frac{F}{C}} \right)}{\partial k} \times \frac{k}{k+1-\frac{F}{C}} + p'\left(\frac{k}{k+1-\frac{F}{C}} \right) \times \frac{\partial \left(\frac{k}{\left(k+1-\frac{F}{C}\right)^2} \right)}{\partial k} \right] \quad (5.4)$$

Now, applying:

$p'(\cdot) > 0, p''(\cdot) > 0, A'(\cdot) > 0$ (properties of *A* and *p*) and:

$$\frac{\partial \left(\frac{k}{k+1-\frac{F}{C}} \right)}{\partial k} = \frac{(k+1-\frac{F}{C}) - k}{(k+1-\frac{F}{C})^2} = \frac{1-\frac{F}{C}}{(k+1-\frac{F}{C})^2} < 0, \text{ as } F > C; \quad (5.5)$$

$$\frac{\partial \left(\frac{k}{\left(k+1-\frac{F}{C}\right)^2} \right)}{\partial k} = \frac{(k+1-\frac{F}{C})^2 - k \cdot 2 \cdot (k+1-\frac{F}{C})}{(k+1-\frac{F}{C})^4} = \frac{k+1-\frac{F}{C}-2k}{(k+1-\frac{F}{C})^3} = \frac{1-\frac{F}{C}-k}{(k+1-\frac{F}{C})^3} < 0 \quad (5.6)$$

as $1-\frac{F}{C} < 0, (k+1-\frac{F}{C}) > 0;$

Using these inequality we can easily conclude, that $\frac{\partial D}{\partial k} > 0$ and therefore:

$$\frac{dF^*}{dk} > 0. \quad (5.7)$$

Now let's look at $\frac{dX}{dk}$.

In case of corner solution we know that $X = \frac{k}{k+1-\frac{F}{C}}$, so

$$\frac{dX}{dk} = \frac{k+1-\frac{F}{C} - k\left(1-\frac{1}{C}\frac{dF}{dk}\right)}{\left(k+1-\frac{F}{C}\right)^2} = \frac{1-\frac{F}{C}+k\frac{1}{C}\frac{dF}{dk}}{\left(k+1-\frac{F}{C}\right)^2} = \frac{C-F+k\frac{dF}{dk}}{C\left(k+1-\frac{F}{C}\right)^2}. \quad (5.8)$$

Denominator of this expression is always positive, so we are interested in the sign of nominator. If we take derivative of the nominator with respect to *k*, we will get:

$$\frac{d}{dk}\left(C-F+k\frac{dF}{dk}\right) = -\frac{dF}{dk} + \frac{dF}{dk} + k\frac{d^2F}{dk^2} = k\frac{d^2F}{dk^2}. \quad (5.9)$$

So, if we assume that $\frac{d^2F}{dk^2}$ is negative (which is quite natural), then we will get that the derivative of nominator is a decreasing function. Thus, $\frac{dX}{dk}$ can change its sign no more than once (and if it does, it is positive before the "change" point and negative after it).

- *Safe policy*

As shown above, in this case *F* and *X* do not depend on *k*, *X*=1 (as there is no risky investments) and *F*=*C* (the bank invests only *C* into long-term instruments under assumption that *R*=1).

- *The existence and allocation of the three types of solutions*
- *Transition between solutions*

The question of how the solutions transform one into other as *k* passes critical values (*k*,k***), remain unanswered. In fact, little can be said about *k** – connection of "safe" and "corner" solutions. The case of *k*** is, however, clear. The fact is demonstrated by the following lemmas

Lemma 1. The solution of "risky" problem (which provides "corner" and "interim" solutions)

$$(1-p(X))(((k+1)C-F)X-kC+A(F)) \to \max_{X,F:s.to:} \quad X((k+1)C-F)-kC \geq 0 \quad (*) \tag{4.4}$$

depends continually on *k* and is unique.

Proof.

□ At each level of *k* the problem is convex – the function maximized is strictly convex and the area of possible values of *X* and *F* is convex too (it is defined by several linear restrictions on *X* and *F* – (*) and restrictions of non-negativity of *X* and *F*). This implies uniqueness of solution at each *k*. Furthermore, under assumptions of smoothness of $p(\cdot)$ and $A(\cdot)$, this solution is continuos in *k*.■

Using this lemma, we can easily see that the solution of the maximization problem is unique at *k*=*k***, so "corner" and "interim" solutions are continuously

connected to each other. Now let us turn to the question of the solutions allocations along *k* line. For this purpose we have to prove two lemmas.

Lemma 2. If at some $k=k_1$ solution of bank's problem is of "safe" nature, than for $\forall k < k_1$ the solutions can be of the "safe" type only.

Proof.

□ Indeed, "safe" solution at $k=k_1$ implies that "safe": portfolio (*F=C, X=1)* provides more expected profit than any "risky" one, which means that (expected) marginal profitability of long-term-investments (equaling *A'*(*F=C*)) is higher than expected marginal profitability of short-term investments (which has its maximum at *R**). At lower *k*s expected marginal profitability of both types of investments does not change, thus creating no incentives to turn to the "safe" solution. ■

Lemma 3. If at some $k=k_2$ solution of the bank's problem is of "interim" nature, then for $\forall k > k_2$ have to be of the same kind.

Proof.

□ Suppose *k* increases from $k=k_2$. Firstly, note that the solution can never switch to "safe" one. Indeed, marginal profitability of investments at "safe" solution is constant and equals *A'*(*C*)>*R** while marginal profitability at "interim" solution equals *X*(*k*) and $X(k)(1-p(X(k))) < R^*$, so, as available funds increase, no additional incentives to turn to "safe" solution can arise.

Further, if we consider possibility of switching to "corner" solution, we should note that with the increase in *k X* rises and *F* falls, so left-hand side of (*), i.e. $X((k+1)C-F)-kC$ rises, so, taken into account continuos dependence of "risky" solutions on *k*, there are no incentives that may force the bank to turn to "corner" solution. ■

Finally let us assume that *A*(*F*) is such that there is a point, which corresponds to the "corner" solution with *X*>*X**.

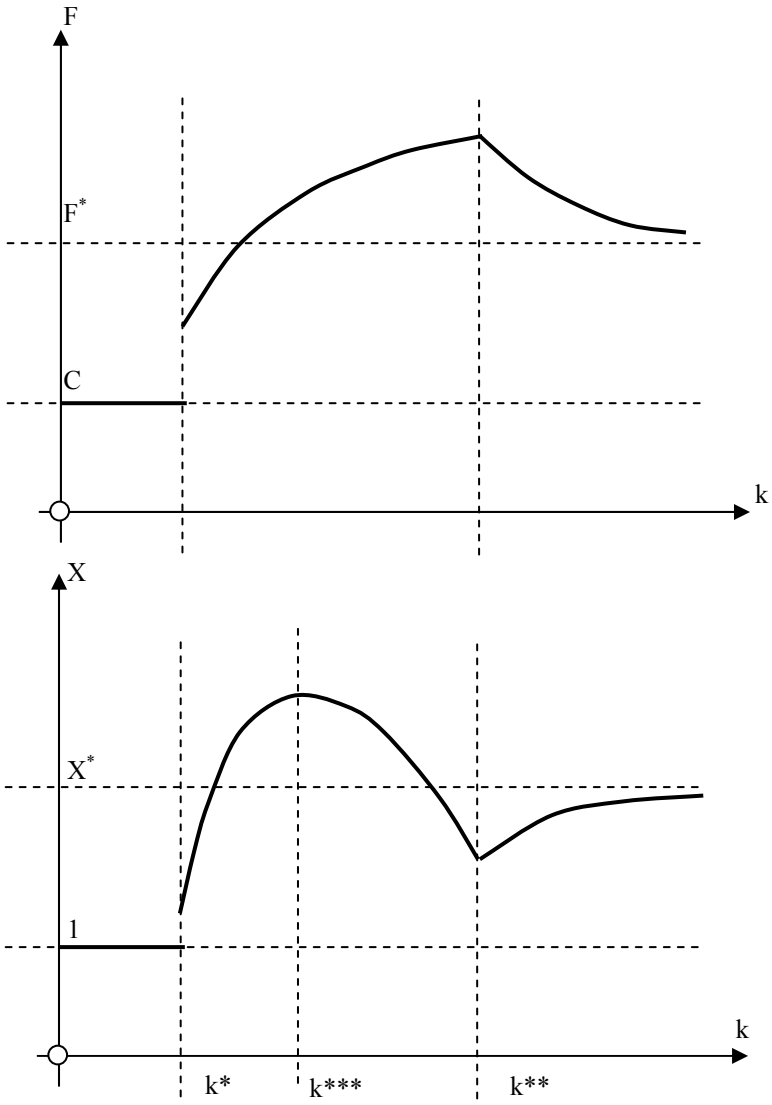
These two lemmas and the last assumption allow describing of possible variants of placement of these solutions on *k* line. There are some

$0 \le k^* \le k^{**} \le \infty$ such that all “safe” solutions are on $k \in [0; k^*]$, all “corner” solutions – on $k \in [k^*, k^{**}]$ and “interim” – on $k \in [k^{**}, \infty)$.

Moreover, Lemma 1 allows to conclude that *k*** can be found as crossing point of solutions to "corner" and "interim" solutions to problem of the bank in case of risky policy. Indeed, as solution is in fact continuos and unique, "corner" solution can transform into "interim" only in intersection.

- Implications.

Let us consider the dynamics of *F* and *X* with respect to *k*. If *k* equals zero then bank behaves safely. If *k* begin to increase then bank will switch to “corner strategy” at some critical *k*=*k**. At this point the value of *X* begin to increase to some *X*>*X** (risky investments appear in corner solution) and *F* jumps from *F*=*C* in “safe” case to some *F*≥*C* in "corner" case as the bank now need to invest less in short-term instrument to cover the debt. If *k* proceeds to increase then at *k*=*k*** bank will turn to “interim” strategy (at this point expected profits for “corner” and “interim” types equals each other). After this point as *k* increases further (to infinity), *F* tends to *F** and *X* tends to *X** as at large *k* the impact of *C* (and *F* with *A*(*F*)) disappears and *X* will be chosen to maximize *X*(1-*p*(*X*)+o(*X*)) and thus tend to *X** (assuming *p*(·) is smooth enough). The value of *F* will be chosen to maximize essentially *X*(A(*F*)-*F*), and therefore *F* tends to *F** as *k* approaches infinity. The behaviour of *F* and *X* is summed up in the following graphs:



6. Reserve requirements.

In the real world, there are different norms associated with reserve requirements, both on borrowed and invested funds. In the paper we concentrate our attention on reserves applied to banks investments. We will consider requirements on short-term investments as they are easier to implement and enforce, moreover, changes in this regulations face quicker response of banks.

As we can see, the nature of the regulation is quite different from previous one and could be modeled as follows. If the agent decides to invest in a risky (short-term) instrument P unit of wealth, then he has to reserve βP unit at a regulatory site (or, in our model, to invest βP into risk-free instrument). In our

model we assume that regulating body can distinguish between short-term risky investments and long-term ones. Under this assumption such a regulation could decrease attractiveness of risky instrument in comparison to long-term investments. But the conclusion is very preliminary and overall effect of the regulation on bank policy is ambiguous. The following analysis is meant to clarify it.

- *Calculations*

First of all, it should be noted that the division of solutions (of bank's problem) into three kinds still holds - there are solutions where the bank is always sound ("safe policy"), solutions where the bank is sound only if risky investments succeed ("risky policy"), which in turn subdivides into two cases – the one with strict equality of liabilities and short-term returns ($\alpha X((k+1)C-F)+(1-\alpha)((k+1)C-F)-kC=0$), i.e. "corner solution" and the one with inequality ("interim solution").

- *Safe policy*

In this case nothing is invested into risky asset (under assumption of $A'(C) > p(X^*)X^*$), so the reserve requirement changes nothing: $F=C,\ X=1$.

- *Risky policy*

In this case the bank invests both into risky and risk-less short-term assets (due to nature of regulation), but, again, it also invest into riskless asset no more than required. To see this, we rewrite bank problem in case of risky policy, i.e. bankruptcy probability is *p*(*X*):

$$\begin{gathered}(1-p(X))(\alpha((k+1)C-F)X+(1-\alpha)((k+1)C-F)-kC+A(F))\to\max_{X,F:s.to:}\\ \alpha X((k+1)C-F)+(1-\alpha)((k+1)C-F)-kC\geq 0\quad (**)\end{gathered}\tag{6.1}$$

Reserve requirements restriction looks as follows:

$$\frac{(1-\alpha)((k+1)C-F)}{\alpha((k+1)C-F)}\geq\beta\Leftrightarrow\frac{1-\alpha}{\alpha}\geq\beta\Leftrightarrow\alpha\leq\alpha^*=\frac{1}{1+\beta}.\tag{6.2}$$

So, again, there is no point for the bank to invest into safe asset no more than required as in case of bankruptcy the bank will get zero (i.e. extra investments into riskless asset make no difference) and in case of success the bank profit

would increase as α increases up to α^*. So, $\alpha = \alpha^* = \frac{1}{1+\beta}$ and bank's problem can be rewritten as follows:

$$\begin{aligned}(1-p(X))((k+1)C-F)(X\alpha^*+1-\alpha^*)-kC+A(F)) \to \max_{X,F:s.to:}\\ ((1+k)C-F)(X\alpha^*+1-\alpha^*)\geq kC\end{aligned} \tag{6.3}$$

- Behaviour of *F*

Let us introduce new variable and function:

$$\begin{aligned}&X_\beta = \alpha^* X + 1 - \alpha^*,\\ &p_\beta(X_\beta) = p\left(1+\frac{X_\beta - 1}{\alpha^*}\right) = p\big(1+(X_\beta-1)(1+\beta)\big)\end{aligned} \tag{6.4}$$

In terms of X_β and $p_\beta(\cdot)$ bank's problem will look like:

$$\begin{aligned}(1-p_\beta(X_\beta))(((k+1)C-F)X_\beta - kC + A(F)) \to \max_{X,F:s.to:}\\ X_\beta((k+1)C-F)-kC\geq 0\end{aligned} \tag{6.5}$$

This is the same problem we had in unrestricted case for risky policy (compare with (4.4)) and, as we see below, $p_\beta(\cdot)$ has all required properties. So, for each β all results above still hold (in terms of these new X_β and $p_\beta(\cdot)$). Further, we are going to analyze dependence of solution on regulation parameter β. We start with description of X_β and $p_\beta(\cdot)$

$X_\beta = \alpha^* X + 1 - \alpha^*$ – just linear function of X.

$p_\beta(X_\beta) = p\big(1+(X_\beta-1)(1+\beta)\big)$ – again, convex function and $p_\beta(1) = 0.$

Indeed,

$$\begin{aligned}&p'_\beta(X_\beta) = (1+\beta)p'(1+(X_\beta-1)(1+\beta)) > 0,\\ &p''_\beta(X_\beta) = (1+\beta)^2 p''(1+(X_\beta-1)(1+\beta)) > 0,\\ &p_\beta(1) = p(1+(1-1)(1+\beta)) = p(1) = 0.\end{aligned} \tag{6.6}$$

X_β can be described as weighed return of portfolio consisting of α^* of risky asset and (1-α^*) of safe asset.

Now we are going to consider "interim" and "corner" solutions.

- *Corner solution*

As we know, solution satisfies (compare with (4.9)):

$$D(F,k,\beta)\equiv\left(1-p_\beta(\frac{k}{k+1-\frac{F}{C}})\right)A'(F)-p_\beta'(\frac{k}{k+1-\frac{F}{C}})\times\frac{k}{(k+1-\frac{F}{C})^2}\times\frac{1}{C}\times A(F)=0, \quad (6.6)$$

$$X_\beta=\frac{k}{k+1-\frac{F}{C}}.$$

We are interested in $\frac{dF}{d\beta}=-\frac{\partial D/\partial\beta}{\partial D/\partial F}$. It is known from earlier considerations, $\frac{\partial D}{\partial F}<0$. Look at $\frac{\partial D}{\partial\beta}$:

$$\frac{\partial D}{\partial\beta}=-\frac{\partial}{\partial\beta}(p_\beta(\frac{k}{k+1-\frac{F}{C}}))A'(F)-\frac{\partial}{\partial\beta}(p_\beta'(\frac{k}{k+1-\frac{F}{C}}))\times\frac{k}{(k+1-\frac{F}{C})^2}\times\frac{1}{C}\times A(F)<0 \quad (6.7)$$

as

$$\frac{\partial}{\partial\beta}(p_\beta(X_\beta))=(X_\beta-1)p'(1+(X_\beta-1)(1+\beta))>0 \text{ for } X>1,$$

$$\frac{\partial}{\partial\beta}(p_\beta'(X_\beta))=(1+\beta)^2p'(1+(X_\beta-1)(1+\beta))+p'(1+(X_\beta-1)(1+\beta))>0 \text{ for } X>1.$$

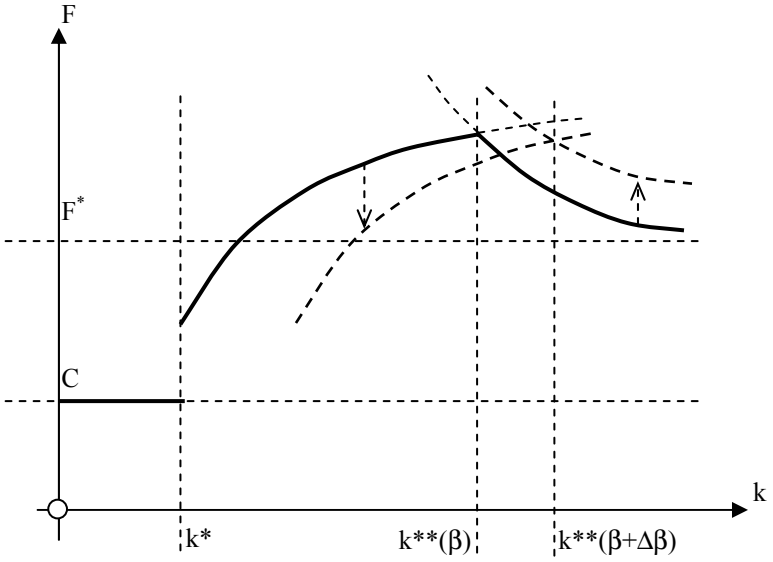
Thus, $\frac{dF}{d\beta}=-\frac{\partial D/\partial\beta}{\partial D/\partial F}<0$, i.e., as β rises (requirements toughen), *F* falls (note that X_β falls too).

- *Interim solution*

In this case solution satisfies (compare with (5.1)):

$$B(X,k,\beta)=$$
$$=(1-p_\beta(X_\beta))((k+1)C-F(X_\beta))-p_\beta'(X_\beta)\left[((k+1)C-F(X_\beta))X_\beta-kC+A(F(X_\beta))\right]=0, \quad (6.8)$$
$$\text{where } F=F(X_\beta)=(A')^{-1}(X_\beta)$$

Firstly, we will analyze the sign of $\frac{dX_\beta}{d\beta} = -\frac{\partial B / \partial \beta}{\partial B / \partial X_\beta}$ and, again, we know that $\frac{\partial B}{\partial X_\beta} < 0$. Now let us look at $\frac{\partial B}{\partial \beta}$:



$$\frac{\partial B}{\partial \beta} = -\frac{\partial}{\partial \beta}(p_\beta(X_\beta))((k+1)C - F(X_\beta)) - \\ -\frac{\partial}{\partial \beta}(p_\beta'(X_\beta))\left[((k+1)C - F(X_\beta))X_\beta - kC + A(F(X_\beta))\right] < 0. \quad (6.9)$$

Thus, $\frac{dX_\beta}{d\beta} = -\frac{\partial B / \partial \beta}{\partial B / \partial X_\beta} < 0$, i.e. X_β falls as β rises. This means that $F = (A')^{-1}(X_\beta)$ rises.

Thus, we have different behavior of *F* in "corner" and "interim" solutions. This allows to deduce that *k*** rises as β rises. Indeed, as *k*** can be determined from crossing of curves, which give solutions for "corner" and "interim" cases (see figure below) and *F* is increasing in *k* at $k \in [k^*, k^{**}]$ (under the assumptions made above) and decreasing at $k > k^{**}$. Thus, crossing point will move to the right as β rises.

- *Behaviour of X*

Although we know that X_β falls as β rises in both "interim" and "corner" solutions, $X = 1 + (X_\beta - 1)(1+\beta)$ can move either way with rise of β. Nevertheless, in case of "interim" solution it can be shown that *X* falls.

So, suppose that solution is of "interim" nature (and remains "interim" if β varies slightly), i.e. $((1+k)C - F)(X\alpha^* + 1 - \alpha^*) > kC$. Firstly, we will show that, as in unrestricted case, the level of risk can not be "too high":

Proposition 1'. In case of "interim solution" $X \le X^*$.

Proof.

□

The logic is the same as in case of the capital requirement: in "interim solution", if $X > X^*$, small decrease in *X* can not disturb "resource inequality" $((1+k)C - F)(X\alpha^* + 1 - \alpha^*) > kC$, increasing at the same time expected profit from the short-term investments and increasing the probability of obtaining return from the long-term investments (i.e. increasing expected return from them). Again, at small enough ΔX

$$[1 - P(X)]\alpha X((k+1)C - F) < (1 - P(X - \Delta X))\alpha(X - \Delta X)((k+1)C - F);$$
$$(1 - P(X))A(F) < (1 - P(X - \Delta X))A(F);$$
$$(1 - P(X))(1 - \alpha)((k+1)C - F) = (1 - P(X))(1 - \alpha)((k+1)C - F).$$

Thus, summing these three (in)equalities, we will get that at small enough ΔX expected profit of the bank can only increase.

So, in case of "interim solution", $X \le X^*$, and $1 - p(X) - p'(X)X > 0$.

■

Now rewrite bank problem as follows (forgetting about "resource inequality"):

$$\begin{aligned}&(1 - p(X))((\alpha^*(k+1)C - \alpha^* F)X - (\alpha^*(k+1) - 1)kC + \\ &+ \left[(\alpha^* k + \alpha^* - 1)C + (1 - \alpha^*)((k+1)C - F) - kC + A(F))\right] \to \max\end{aligned} \tag{6.10}$$

Then, denoting:

$$\begin{aligned}&k_\beta + 1 = \alpha^*(k+1), \text{ i.e. } k_\beta = \alpha^*(k+1) - 1, \\ &F_\beta = \alpha^* F, \\ &A_\beta(F_\beta) = (\alpha^* k + \alpha^* - 1)C + (1 - \alpha^*)((k+1)C - F) - kC + A(F)),\end{aligned} \tag{6.11}$$

we will get exactly the same problem we had in unrestricted case, but in terms of $k_\beta, F_\beta, \text{and } A_\beta$. Concavity of $A_\beta(\cdot)$ holds (as $A(\cdot)$ is disturbed by linear function) and positivity of A' will hold if we suppose that $A'(F)>1-\alpha^*$, which is certainly true if α^* is not very low (i.e. β is not very high) or F is not very high. So, we are again reduced the problem to the sort we solved above and we know that solution is given by:

$$B_X(X,k,\beta) \equiv (1-p(X)((k_\beta+1)C - F_\beta(X)) -$$
$$- p'(X)\left[((k_\beta+1)C - F_\beta(X))X - k_\beta C + A_\beta(F_\beta(X))\right] = 0, \qquad (6.12)$$
$$\text{where } F_\beta(X) = \alpha^*(A')^{-1}(X).$$

We are interested in sign of $\frac{dX}{d\beta} = -\frac{\partial B_X / \partial \beta}{\partial B_X / \partial X}$. Again, $\frac{\partial B_X}{\partial X} < 0$ and we analyze sign of $\frac{\partial B_X}{\partial \beta}$:

$$\frac{\partial B_X}{\partial \beta} = (1-p(X))\left(-\frac{(k+1)C}{(1+\beta)^2} + \frac{F(X)}{(1+\beta)^2}\right) -$$
$$- p'(X)\left[\left(-\frac{(k+1)C}{(1+\beta)^2} + \frac{F(X)}{(1+\beta)^2}\right)X + \frac{(k+1)C}{(1+\beta)^2} + \frac{-(k+1)C}{(1+\beta)^2} + \frac{1}{(1+\beta)^2}\left((k+1)C - F(X) + A(F)\right)\right] =$$
$$= -\frac{1}{(1+\beta)^2}\left[\left((k+1)C - F(X)\right)\left(1-p(X) - p'(X)X\right) + p'(X)\left((k+1)C - F(X) + A(F)\right)\right] < 0$$
$$\text{as } (k+1)C - F(X) > 0, 1 - p(X) - p'(X)X > 0.$$

So, $\frac{\partial X}{\partial \beta} < 0$, i.e. in "interim" solution the toughening of requirements leads to decrease in the level of risk (at least if β is not too high).

The question of behaviour of X in case of corner solution remains unanswered, it should depend of properties of $A(\cdot)$ and $p(\cdot)$.

- *The existence and allocation of the three types of solutions*
- *Transition between solutions*

Behaviour of the three types of solution resembles the case of capital restriction. In fact, all lemmas for capital restriction have their counterparts in case of reserve requirements.

Lemma 1'. The solution of “risky” problem (which provides “corner” and “interim” solutions)

$$(1-p(X))((k+1)C-F)(X\alpha^*+1-\alpha^*)-kC+A(F))\to\max_{X,F:s.to:}$$
$$((1+k)C-F)(X\alpha^*+1-\alpha^*)\geq kC \qquad (6.3)$$

depends continually on k and β and is unique.

The proof of it is fully similar to the proof of Lemma 1, which is based on convexity of the problem.

Again, it follows that "corner" and "interim" solutions are continuously connected.

Allocation of solutions can be deduced from following lemmas:

Lemma 2'. If at some $\beta=\beta_1$ solution of bank’s problem is of “safe” nature, than for $\forall\beta>\beta_1$ the solutions can be of the “safe” type only.

Proof.

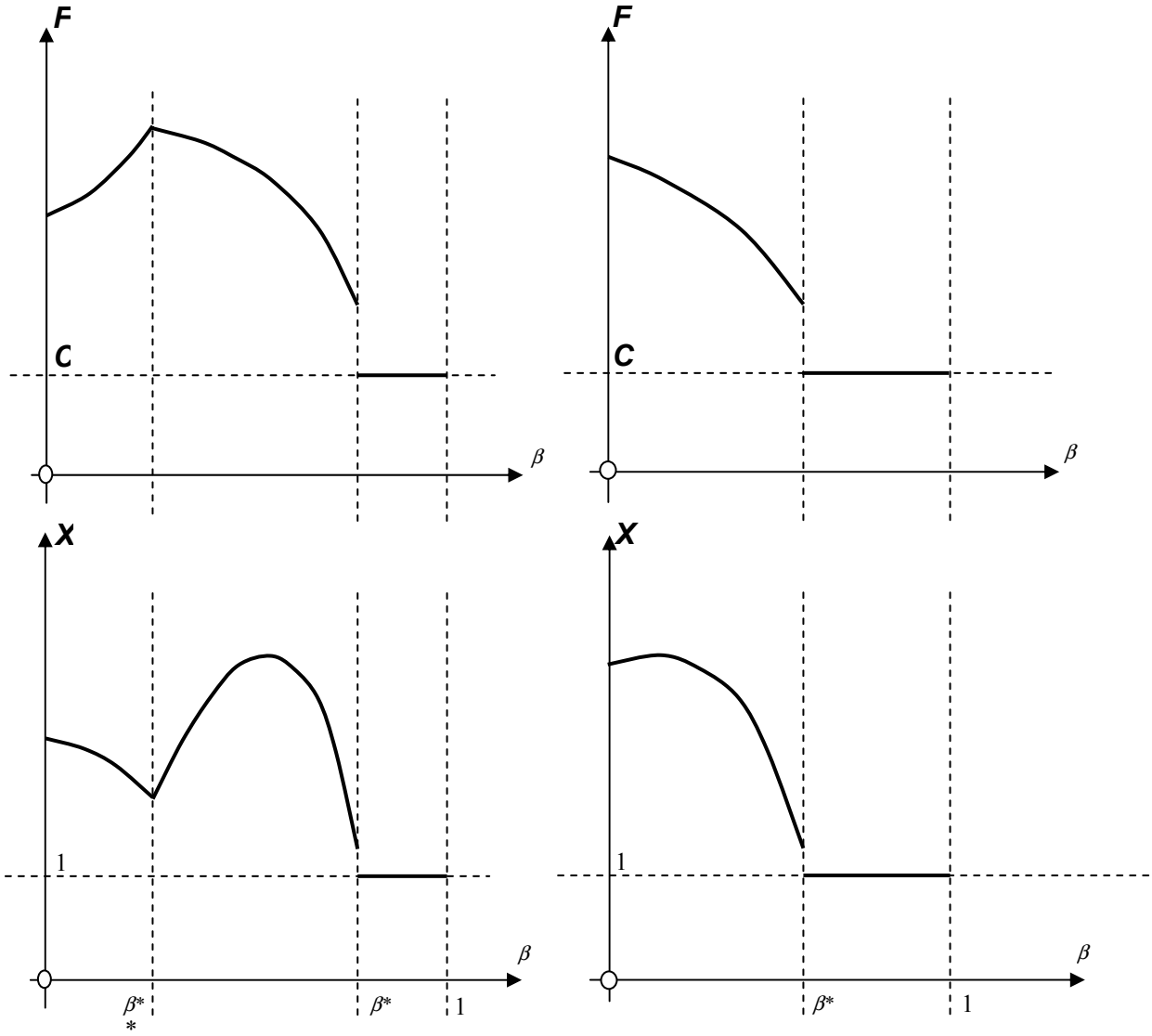
□ Again, it is similar to Lemma 2. Intuitively, the less free resources the bank has, the less incentives it has to deviate from "safe" strategy, i.e. turn to risky assets. ■

Lemma 3'. If at some $\beta=\beta_2$ solution of the bank’s problem is of “interim” nature, than $\forall\beta<\beta_2$ can be of the same kind.

Proof.

□ Again, as in Lemma 3, additional resources can only reduce incentives to turn either to "safe" of "corner" policy.■

Furthermore, at very high βs (in neighborhood of unity) the bank is clearly at "safe" solution (as it in fact can not invest in risky instrument). On the other hand, at β=0 (i.e. in unrestricted case), the kind of solution is defined by k: for $k\in[0,k^*]$ – "safe" solution, $k\in[k^*,k^{**}]$ – "corner" solution, $k\in[k^{**},+\infty]$ – "interim" solution. As β decreases from unity to zero, the solution can transform from "safe" to "corner", then to "interim", but never in reverse order, i.e. there exist such $1\geq\beta^*\geq\beta^{**}\geq0$ that for $\beta\in[\beta^*,1]$ the solution is of "safe" nature, for $\beta\in[\beta^{**},\beta^*]$ – "corner" and for $\beta\in[0,\beta^{**}]$ – "interim". The figure below (on the left) illustrates a behaviour of F and X with respect to β. The value of k is taken to be greater



than k^{**} to show all kinds of solutions (if not, "interim" solutions can not exist for such k). Moreover, it is assumed that β^{**} is small enough so that X really decreases as β increases from zero to β^*.

In another case ($k<k^{**}$ – depicted on the right-hand side) the bank operates in "corner" mode even if $\beta=0$. Such a behaviour can be interpreted as follows: if capital requirements are excessively toughened, relaxation of reserve requirements (even down to zero) can not make bank operate in "interim" mode.

Implications.

As one can see, both kinds of regulation: h1 norm and reserve requirements (which we model through variation of k and β correspondingly) affect the behaviour of banks in rather similar way. We can sum up their effect on X and F in following table:

	"corner" solution		"interim" solution	
	F	*X*	*F*	*X*
Increase in *k*	+	+/-	-	+
Increase in β	-	+/-	+	-

Taking into account that an increase in *k* is treated as the relaxing of regulation, while increase in β – as toughening, one can see that both kinds of regulations affect banks' behaviour in the same way. Additionally, toughening of either regulation can make from "interim" bank "corner" one: as *k* decreases, it can simply become lower than *k*** while increase in β increases *k***. So, the model can not provide unique answer which kind of regulation is "better". Other factors should be taken into account, the discussion of which is outside of this model

7. Policy implications

Now let us turn to the banking regulation. We are going to speak about capital requirements regulation, but said below is relevant for reserve requirements also. Specific features of the regulation are to be discussed in conclusion. Moreover, we are going to discuss well-timed measures, when banks have enough time to adapt their portfolios.

Let us assume that banking supervisors are not satisfied with current standing of banking system and the only available instrument is the regulation of *k*. Suppose that k_{max}, which corresponds to a particular bank, is more than *k***. In this case the regulators can reach desired effect through the toughening of the capital requirement. In this case the level of risk falls and the level of long-term investments increases. But as regulation strengthens, k_{max} reaches *k*** and becomes even lower. After that the bank behavior changes. The level of long-term investments begins to decrease and the level of riskiness - to increase. After reaching *k**** which corresponds to the maximal level of *X* both the risk and amount of long-term investments falls until the switching at *k*=*k** to the lowest level, which corresponds to safe policy.

Let us now consider how this framework could be applied to Russian case.

Firstly, let us examine the case of a large Russian bank that was a member of FIG. As such a bank had a lot investment opportunities provided through their control over FIG's enterprises, it is only logical to assume that the level of long term investment was high. In our model such an investment choice is characterized by *"corner solution"*. It means that critical levels of k are such that $k^{***}<k<k^{**}$, where k corresponds to the bank's level. It was shown that in the case toughening of capital requirements would reduce long-term investments, but has unclear effect on the level of the risk. If $k<k^{***}$, then the regulators would reach desired effect, but if $k^{***}<k<k^{**}$, then it would be unclear – a small decrease in k would lead to an increase in X, while a large one (making k less than k^{***}) – will lead to a decrease, making total effect ambiguous. But the experience of Russia demonstrated that the largest banks that had significant long-term investments conducted excessively risky policy. Therefore such banks in our framework are represented by k_S that lie in the neighborhood of k^{***}. Thus a well-timed substantial toughening of the capital requirement would improve the banks stability.

Let us turn to the case of small and medium Russian banks which typically had relatively small amount of long-term investments. These banks usually earned their profits from short-term operations. Thus, such banks can be considered as being in "interim" solution mode ($k>k^{**}$). As it was studied above under this condition toughening of capital restrictions has unclear effect. If the requirement toughened not very significantly ($k_{max}>k^{**}$) then the regulatory authorities would reach the desired effect. In this case the banks decrease the level of risk and improve their long-term position. But in case of further strengthening of the regulation the banks would be forced to switch into riskier mode (*"corner" solution*), sharply increasing the level of risk. Therefore in case of small and medium Russian banks too strong capital requirements could have perverse effect, only increasing the risk of banks portfolios.

As one can see, toughening of capital requirements would have unclear effect on banking sector of Russia – soundness of one group of banks would improve, while another group would suffer. Thus, we can deduce that introduction of bank specialisation could significantly improve the situation. Capability to issue different regulations for different groups of banks would

provide regulating bodies with instruments for simultaneous decrease in levels of risk taken by all banks.

As we have shown, two ways of banking regulation (capital requirements and reserve requirements), while quite different, affect banks very similarly. As the model itself can not provide unique answer, which kind of regulation is preferable, other factors should be taken into account. Firstly, these regulations have different effect on money demand: toughening capital requirements decreases money demand while reserve requirements do not. Decrease in money demand is usually unfavorable for regulator: excess money allow for creation of new banks, which increases competition and decreases overall stability of banking sector. Secondly, toughening reserve requirements directly increases reserves, which decreases potential losses of creditors and depositors and improve overall stability.

Moreover, there are differences in efficiency of the two regulations, which can not be demonstrated in our framework. Consider two banks and suppose that regulating body goes to slightly toughen the norms for both banks. If individual *k*s of these banks significantly differ, then capital requirement for one of the banks will be non-limiting (and thus inefficient); if the regulator would want to affect both banks, one of the bank will face excessive regulation. Reserve requirements have no such deficiency. Slight toughening of reserve norms will be limiting for both banks. Thus, as both kinds of regulation affect banks' stability in similar way, reserve requirements seem to be preferable from the standpoint of versality.

Conclusion

This paper has shown that there was a large field for improvement of Russian banking legislation. The CB could implement a number of regulation that proved their efficiency in developed countries as well as use existing regulations more effectively.

It was shown how toughening of regulations would have positive effect on soundness of one group of banks while worsening situation of others. Moreover, it was demonstrated how supervisory authorities could significantly improve the banking sector stability through the application of capital and

reserve requirements and the only condition for their successive implementation was the introduction of banking specialisation. Additionally, it was shown that the two regulations affect the riskiness of bank portfolio in the same manner although the overall effect of the regulations on the economy differ in many ways.

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Appendix.*An analysis of major causes of Russian banks' bankruptcy*

The classification of main causes of the bankruptcy

Russian bank met serious problems much earlier the GKO default. The basic characteristics began to worsen beginning from January 1998. For instance aggregated capital of the largest twenty Russian banks (excluding Sberbank and Vneshtorgbank) decreased by 15 per cent during the first half of 1998, the aggregated value of liquid assets had shortened three times for the same period of time.

There were a lot of various other causes that worsened banks' conditions. For example, banks fiercely competed for all spheres of business, qualification of bank managers was too low, there were a small number of profitable instruments in Russia etc. There is a list of most significant problems.

- Excessive dependence of the banks on foreign credits
- The massive withdrawing of deposits
- Low quality of banking management
- Excessive dependence of the banks on associated non-financial companies
- Depreciation of Russian government bonds
- GKO default
- Off-balance activities (forward contracts)

The presence of the problems was typical for all Russian largest banks, although the value of losses from particular one differs from bank to bank.

After the enumeration of the problems let us consider each of them in more details.

1) GKO-OFZ, OVVZ and eurobonds of Russia.

At the time of Asian financial crisis Russian banks had a large portion of the government bonds (GKO, OFZ, OVVZ and eurobonds) in their investment portfolios. The aggregated value of the bonds was more than 11 billion dollars.

Table 1. Government bonds

Bank	Share of the government bonds in the banks assets			
	01.12.96	01.04.97	01.09.97	01.10.98
Sberbank of Russia	55,78	63.41	66.06	54.63
Vneshtorgbank	21,29	24.67	27.27	10.82
NRB	69,01	50.63	39.19	7.69
Gazprombank	9,97	12.26	8.52	2.72
IFC	16,79	27.28	14.16	5.03
International Moscow Bank	-	18.06	15.04	8.18
MIB	12,92	15.10	15.39	8.83
Onexim-bank	9,78	10.74	9.46	11.79
Mosbusinessbank	25,58	27.92	27.11	17.72
Avtobank	35,67	27.70	41.15	21.59
SBS-Agro	41,38	37.69	29.67	4.14

The worsening financial situation in developing countries negatively influenced the value of the long term bonds (OVVZ, GKO, PRIN, IAN) prices. The prices and liquidity of Russian foreign bonds began to decrease at the beginning of 1998 year, as a result of it banks incurred significant losses, in some cases they exceeded own capital of banks. Triggered sells of the bonds further decreased prices. Finally, the market was destroyed by the August default.

The situation with GKO-OFZ differs a little from foreign debts one. The situation on GKO-OFZ market began to worsen in 1997. But the maturity of GKO issue was in average equal to one year, so bank could hold bonds until its maturity, because of GKO had not lost liquidity. Thus, the banks did not make efforts to diminish the fraction of GKO-OFZ in their portfolios. Moreover, even after the default, especially for the largest banks, GKO remained as a relatively liquid asset.

Thus, it is possible to state that the GKO default did not seriously hurt the banks, and banks incurred much higher losses from operations with foreign government bonds.

2) Withdrawal of deposits

During 1998 enterprise accounts steadily decreased in value. To the middle of 1998 the deposits in rouble had shortened by 7 per cent, in foreign currency by 6 per cent with comparing to the beginning of 1998.

Table 2. Deposits

	Apr 98	Jul 98	Aug 98	Sep 98	Oct 98	Dec 98
Deposits in billion RUR	153,4	155,7	150,9	135,5	123,7	125,9
Sberbank	120,7	121,2	117,3	108,4	101,3	107,9
The other banks	32,7	34,5	33,6	27,1	22,4	18
Deposits in foreign currency billion $.	5,5	6,1	6,5	5	4,5	3,1
Sberbank	2,2	2,4	2,6	1,9	1,7	1,3
The other banks	3,3	3,7	3,9	3,1	2,8	1,8

source- S.Alexashenko, “The Banking crisis”, Voprosi Economiki, N5

The situation with private deposits is a little different from previous one. Depositors behaved coolly, it allowed banks to compensate the losses of liquidity though the attracting of deposits. During the period from April to August 1998, the growth of deposits in SBS-Agro came to 12 per cent, in Inkom-bank – 17 per cent, in MENATEP – 25 per cent, in Russian Credits – 74 per cent. As a result of it the share of deposits in total liabilities of the four banks increased from 20 per cent on 01.04.98 to 34 per cent on 01.08.98 and of the full banking system from 9,5 per cent to 10,5 per cent. Only in July total amount of deposits began to decrease. During the month the value of deposits in rouble and foreign currency decreased by 1,1 per cent. And only in August 1998 people began to withdraw deposits. Because of it in the third decade their amount felt more than two times. The banking system (excluding Sberbank) lost 46 per cent of rouble deposits and 54 per cent of foreign currency deposits.

3) Liquidity problems

Russian banks at the moment of crisis had comparably low liquidity level. This is due to the fact that during first half of 1998 they had to cover losses. GKO default has lowered liquidity even more. If one include GKO into liquid assets then share of liquid ass ets among all assets was 28%, which corresponded to the volume of demand liabilities. Due to this a lot of banks could not serve their obligations at first days of the crisis.

Table 3. Liquidity

Ratio	Jan 97	Jul 97	Jan 98	Jul 98	Sep 98	Oct 98	Dec 98
To assets							
Liquid assets	6,1	3,7	5,3	4,9	5,3	6,8	7,1
Extended liquid assets	31,2	32,7	28,6	25,9	25,9	14,9	15,1
To liabilities							
Liquid assets	7,3	4,6	6,7	6,2	6,5	8,1	8,2
Extended liquid assets	40,1	40,4	36,6	32,7	26,1	17,5	17,5
To deposits							
Liquid assets	30,8	18,5	28,4	19,4	22	34,2	44,7
Extended liquid assets	158,2	128,4	154,4	102,4	88,1	74,2	95,2

source- S.Alexashenko, "The Banking crisis", Voprosi Economiki, N5

4) Foreign debts

On 01.07.98 the value of banks' debts to foreign creditors was more than 8 billion dollars. More than 75 per cent of the credits belonged to the 20 largest banks. Their deposit and credit liabilities to non-residents came to 21 per cent of their liabilities. For some of the banks (SBS-Agro, Imperial, TOKO-bank) the value exceeded 30 per cent level.

Table 4. Foreign Debts

Bank	Foreign debts 01.10.98			
	Short term liabilities	Syndicated credits	Bonds in foreign currency	Aggregated liabilities
Sberbank	100	225		325
Inkombank	274	140		414
Russian credit	118	229	200	547
SBS-Agro	631	113		744
ONEXIM-bank	353	70	300	723
MENATEP	515	80		595
Vneshtorgbank	356	120		476
Alfa-bank	214	77	175	466
NRB	208	42		250
Avtobank	108	47		155
Most-bank	129			129
IFC	97		51	148
Vozrozhdenie	51			51
Bank of Moscow	15	20		35
Aggregated liabilities	3 169,00	1 163,00	726,00	5 058,00

Source: IC "Troika-Dialog", an. survey "The Russian Banking Sector: Life After Death"

The existing disparity between the level of profitability of instruments nominated in rouble and foreign currency allowed earning extraordinary profit. Most of foreign credit sources were invested in rouble instruments by the banks. But after 1998-year devaluation banks being involved in such activities incurred huge losses.

5) Off-balance operations, forward contract debts

Liabilities of Russian banks concerned with forward contracts exceeded 10 billion dollars. The largest part of contracts were made in the period from April to June 1998, when the majority of non-residents decided to stop investing in Russia bond market and began to actively offer forward contracts to the banks. The indebtedness of the nine largest forward contracts market participators (Sberbank, Vneshtorgbank, ONEXIMbank, SBS-Agro, MENATEP, IFC, Gazprombank) amounted to 3 billion dollars on 01.07.98, it was more than a third of the banking system forward debts. The amount of forward contracts liabilities in some cases exceeded not only own capital but assets of banks (Inkom-bank – 56,2 times capital and 4,7 times assets on 01.07.98, NRB- 28,6 and 9,4, SBS-Agro- 10,8 and 1,2, ONEXIMbank- 9,2 and 1,2). The following table depicts the volume of forward contracts for 10 Russian banks.

Table 5. Forward contracts debts

Bank	Forward contracts 1998.10.01
ONEXIM-bank	1900
Inkom-bank	1884
Vneshtorgbank	608
Avtobank	380
Sberbank	325
NRB	268
MENATEP	100
SBS-Agro	84
Russian Credit	70
IFC	51

Source: IC “Troika-Dialog”, an. survey “The Russian Banking Sector: Life After Death”

For one’s turn the largest banks made a contract with banks from “the second level” (MDM-bank, Unibest etc.). It made a lot of banks to be involved in the forward market. As a result, after the devaluation a huge amount of

banks found themselves in difficult situation, the largest participators of the market incurred losses compared with their assets.

6) Participation of banks in Financial Industrial Groups

Almost all largest private banks participated in various Financial Industrial Groups. It allowed banks to decrease the risk of investments for production companies, which in turn increased the inflow of credits in the domestic industry. It was the main cause why not only banks, but also CB and government actively supported this interdependence. Foreign investors also considered the connections as a positive one. Most of syndicated credits were provided to the banks for development of FIG.

Table 6. Banks & FIGs

Bank	FIG	Type of credit	Mln. $
Alfa-bank	Volzhskay Oil	Syndicated	77
Russian credit	TANAKO	Syndicated	217
Inkom bank	Nosta Oil	Syndicated	503
MENATEP	MENATEP-Rosprom	Syndicated	80
IFC	INTERROS	Syndicated	85
ONEXIM-bank	Volzhskay Oil	Credit back-up line	170
SBS-Agro	Volskay Oil	Syndicated	198

Source: AC “Vedi”, book “Russian Banking System: the crisis and the future”

But this co-operation had an adverse effect too. In most cases the owner of banks were simultaneously the owners of plant, which formed FIG. As a result of it, interests of banks were in minor position to interests of FIG. Moreover, the companies, which actively used resources of banks, were not bound with liabilities of the banks. As an example of such a relationship FIG “MENATEP-ROSPROM-UKOS”.

Table 7. Banks & Enterprises

Bank	**Inkom-bank**	**Russian Credit**	**TOKO-bank**
Industry	Food Engineering industry Military-industrial establishment Metallurgy	Ferrous metallurgy Non-ferrous metallurgy Gold mining	Metallurgy Building

companies	JSC “Babaevskoe” JSC “Rot Front” Novosibirsk candy UzhUralKonditer Sormovskay candy Energomash Sea Technician of non-nuclear under water shipbuilding OKB Suhigi NOSTA-PIPE-GAS JSC “SAMECO”	TOCHNOST TANAKO Svytogor Rushim Oskolskiy still-rolling plant Krasnoyrskiy aluminium plant Novolipeckiy ferrous plant Mihailovskiy GOK Stoilenskiy GOK Lebedinskiy GOK	MIKOM Plants of Kursk region Novokuzneckiy ferrous plant Novokuzneckiy aluminium plant TOKO-House TOKO-Tower
bank	**SBS-Agro**	**MENATEP**	**Imperial**
industry	Oil Non-ferrous metallurgy Financial	Oil Heavy engineering industry Food Textile	Oil gas
companies	Sibneft Dragocennosti of Ural Agroprombank	UKOS Rosprom JSC “GAZ” “Russian products” «Russian textile»	Lukoil RAO “Gazprom”
Bank	**ONEXIM-bank**	**Alfa-bank**	**Most bank**
industry	Non-ferrous metallurgy Oil gas Transportation Precision engineering	Oil Construction Retail Real estate	Information
companies	Norilsk nikel Novolipeck ferrous plant Sidanko North West LOMO	TNK Alfa-Cement Alfa-Estate	Eho of Moscow Newspaper “Seven day” Newspaper “Today” Journal “Itogi” TV company NTV Satellite TV NTV+

It can be seen from the table above, that most of the banks that met solvency problems after the crisis actively participated in FIG and owned of a

large number of enterprises. At the same time most of enterprises, member of the FIG successfully went through the crisis. As an example, FIG “MENATEP-Rosprom-Ukos” can be considered. Oil company “Ukos” strongly develops its business, at the same time “MENATEP” – former owner of the company collapsed in the second half of 1998. The same situation is in cases of “Norilsk Nickel & ONEXIMbank”, “Lukoil & Imperial”, “Aluminium plants &Russian Credits”.